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IOWA METEORITES

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Every day, the earth is bombarded by an estimated 100 tons of interplanetary debris. Most of this is produced by micrometeorites that vaporize high in the atmosphere and slowly settle to earth as a fine dust. Only a rare once-a-day small meteorite survives its passage through the atmosphere to impact the earth. Unfortunately, the vast majority of these go undetected or undiscovered. As a result, it is an important event when a sizable meteorite fall occurs which is well observed and documented. Interestingly, Iowa appears to have been blessed with an inordinate number of these falls within recorded history. In fact, during one period of 43 years, four major meteorite falls were noted in the state. The following is a discussion of meteorites in general, and then an examination of these Iowa falls, as well as one subsequent find which occurred within the state.

Meteors and Meteorites

Surprisingly, as recently as 1800, the scientific community dismissed as superstition the notion of stones falling from the sky. However, on April 26, 1803, a fireball exploded over the village of l'Aigle, France, showering the area with many stones. The subsequent rigorous investigation by French physicist J. B. Biot presented irrefutable evidence that the rock fragments had indeed fallen to earth.

Since that time, scientists have gradually come to understand that most meteorites represent the oldest and least altered material found in the solar system. As such, they offer us our best chance to sample the environment of the primitive solar nebula, and are valued finds.

Our solar system contains an uncountable number of small chunks of matter in orbit around the sun. These range in size from tiny objects less than a millimeter across, to large boulders, tens of meters across. While these rocks remain in space they are referred to as "meteoroides." If, however, they happen to enter the earth's atmosphere, friction causes them to heat up and glow, producing a trail of light. This is a "meteor," also popular known as a "shooting" or "falling star." If the object is not completely vaporized by its swift flight through our atmosphere, it falls to earth, becoming known as a "meteorite" (Abell, 1982).

One of the most amazing facts about meteors is that although their glow can be seen from more than 100 miles away as their passage heats up the earth's air, they are seldom larger than a grain of sand. They shine so brightly because they often hit the upper atmosphere at speeds in excess of a quarter million kilometers per hour, releasing a considerable amount of kinetic energy, even though they are tiny.

A common misconception about meteorites is that they are hot to the touch immediately after landing. However, the outer layers tend to peel off from the meteorite as it plunges into the atmosphere. This is called ablation and the process carries off the heat build-up. In fact, the meteorite which has been in the

"cold storage" of space for billions of years before its entry, has its outer layers recoiled by the slow final descent through the lower part of our air. So immediately after falling, a meteorite would feel cool in your hand.

In all of recorded history, no meteorite fall has killed a human. Animals have occasionally been found dead at the scene of meteorite falls, but no human has fallen victim — yet. The most interesting near fatality is the case of an Alabama woman who in 1954 was injured by a meteorite which crashed through her home. It ricocheted off of her radio, striking her and bruising her hip.

In general, the meteorites which strike the earth can be divided into three classes. The most common type are referred to simply as "stones." These constitute approximately 92 percent of all falls. Stones are silicate in nature and usually resemble ordinary terrestrial rocks. For this reason they are seldom discovered by accident (Claccio, 1983).

The next largest category of meteorites are "irons," constituting 6 percent of all falls. This group is usually disproportionately represented in museums, however, due to the fact that they are so clearly not typical terrestrial rocks. As a result, they are easily recognizable and most commonly sent in for examination. They are usually 90 percent iron, and about 10 percent nickel, and have a melted appearance (Claccio, 1983).

The third type of meteorite is a combination of the first two known as "stony-irons." These represent about 2 percent of all falls. As their name implies, they commonly exhibit small stone pieces set in a matrix of iron (Claccio, 1983).

An estimated 18 meteorites are identified each year (including new falls and old finds) (Nininger, 1972). However, the recent discovery that Antarctica is an ideal hunting ground for ancient meteorites has made this estimate obsolete. In some locations of Antarctica, meteorites are being recovered by the bucket-full.

One of the most comprehensive reports of Iowa's history of meteorite falls is found in the April 1958 issue of the *Palimpsest*, a publication of the Iowa Historical Society. What follows is heavily abstracted from that article by Ben Hur Wilson.

The Marion Meteorite

The first meteorite to fall in Iowa within recorded history occurred on February 25, 1847. As an interesting coincidence, on that same date the governor of the state, Ansel Briggs, signed into law the establishment of the state's first university in Iowa City. However, the important news in that city and surrounding Johnson County on that date was not the new school, but the loud explosions and rumbling heard that afternoon.

Actually, the fall site of the meteorite was approximately 22 miles north of Iowa City. Since the closest town was the then county seat of Marion, it has since been known as the Marion meteorite.

In a sparsely settled state, less than a decade old, hundreds of people surprisingly heard or saw the meteor in its flight. And at least three eyewitnesses actually saw the stones strike the ground. The meteor itself broke up during flight. Thus, there is no single exact fall site, but rather what is known as a "meteorite field," approximately a mile and a half across. This field was in rough timber country along the Cedar River.

At the time the meteorite fell, the sky was described as slightly hazy, but still quite clear. Being February, the ground was still frozen and snow-covered. However, the bright sun had warmed the air to near the freezing point, softening the snow.

The meteor came streaking across the sky from the northwest. The time was 3:00 in the afternoon. Most people in the vicinity first became aware of loud explosions or thunderous rumbling noises. After this, some people reported a whizzing or whistling sound "as if thousands of bullets were flying through the air." Those eyewitnesses within the meteorite field then saw the snow and dirt fly in a number of places as the stones struck the earth. Two or three pieces were picked up immediately. During the next few months, another two or three large pieces were recovered. All together, about five sizable stones, with an approximate weight of 50 to 75 pounds were located. Some uncertainty exists due to the fact that some of the fragments were not preserved. A local farmer was apparently convinced that the shiny inclusions within the rock were silver. As a result, he "ground up a considerable portion of the rock to obtain this silver, and he thought he had saved enough to make fifty cents." Unfortunately, it turned out to be nickeliferous iron. Sadly, this illustrates the fate of many a meteorite.

The Marion meteorite was a type of stony meteorite known as a chondrite. These are the most common of meteorites. Its interior was grey with rounded inclusions of minerals. A thin black exterior coating was formed by melting due to the heat of its atmospheric entry.

Today, the largest portion of the Marion meteorite is in the collection of meteorites owned by Amherst College in Massachusetts. There, one can view two fragments whose combined weight is approximately 40 pounds. Smaller pieces are in collections of the Field Museum in Chicago and a meteorite museum in Tübingen, West Germany.

The Amana Meteorite

Nearly 28 years after the Marion fall, the second known meteorite came down in Iowa. This one occurred on February 21, 1875, and was observed from Omaha to Chicago, and from St. Paul to St. Louis. It was widely seen because it fell early on a Friday evening when many people were still out and about, or were returning from social gatherings. The night was recorded as clear to partly cloudy with moonlight.

The meteor blazed across the sky for approximately ten seconds, moving from south to north. Observers claimed that the meteor's brightness easily eclipsed that of the full moon. And while there was no sound as the meteor passed overhead, approximately two to five minutes afterward (depending upon location) there was a "rumbling roar like the passage of a heavy train over a trestle bridge." This rumbling was followed by a number of sharp detonations.

Like the Marion meteor, this meteor also broke into several pieces. Thus, its material was scattered over a wide area, approximately two miles southwest of Homestead in the Amana Colonies — hence the name, the Amana meteorite. The first piece was discovered a couple of days later by a young girl on her way to school. It was an irregular piece weighing a bit more than seven pounds. A wide-

spread search then began, but produced little. Not until two to three months later when farmers began to cultivate the fields were many small stones discovered. Some were also located in timber, traced by broken branches and scars on the trees.

Gradually, over a period of two and a half years, about 800 pounds of meteoric material was recovered. The largest pieces, 74 and 48 pounds, were discovered just south of High Amana, both buried in frozen ground to a depth of two feet. The composition of the material is very similar to the stoney chondrite which fell near Marion. Today, much of the meteorite has been sent to museums around the world. The two largest pieces, however, along with many smaller fragments, are still at the University of Iowa.

The Estherville Meteorite

Only four years after the Amana meteorite, another large meteorite fell to earth near Estherville in northwestern Iowa. The time was 5:00 in the afternoon on May 10, 1879. The sky was clear in Estherville, but further to the west, a line of thunderstorms was approaching. When first observed, the meteor burst from the thunderheads, traveling from southwest to northeast. Behind it trailed a long white plume.

Many eyewitnesses saw it clearly as it sailed across the sky and out of sight toward Estherville. In the town itself, the first indication was a terrific crash and explosion from above. The meteor apparently broke up at a considerable height above the community, scattering fragments over a long, thin, seven mile oval about two miles north and west of town. Again, a number of witnesses observed pieces impact the earth, including a boy who was herding cattle in the area. He ran into the nearby village of Superior "frightened half out of his wits, declaring that it had been raining stones out on the prairie where he was stationed, and that his cattle had stampeded in every direction." The water in the slough, he reported, had been "peppered" with fragments like hail.



Figure 1
FRAGMENT OF ESTHERVILLE METEORITE

Three large pieces reached the earth. The largest of these was a 431 pound mass found along with some smaller fragments three miles north of Estherville on the southwest corner of the Sever Lee farm. At least three eyewitnesses looked up in time to see debris thrown up by the meteorite's impact. It penetrated the ground to a depth of 14 feet due to the swampy conditions at the fall site. Three days of heavy labor were required to extract this piece from the soggy ground.

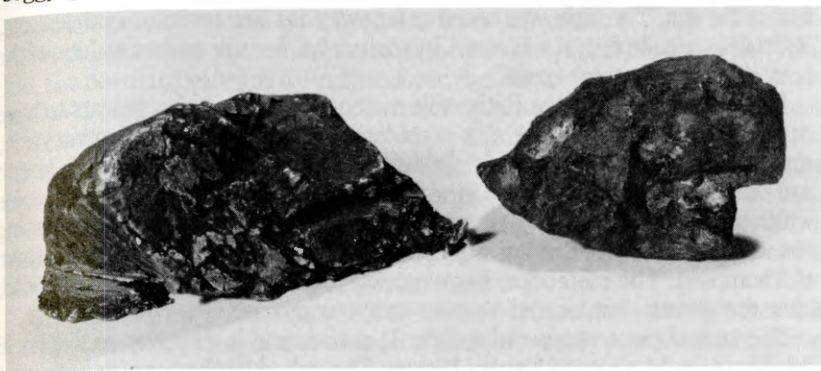


Figure 2
ESTHERVILLE METEORITE FRAGMENT (on left) AND
ODESSA, TEXAS, METEORITE FRAGMENT (on right).

The day after the fall, another large fragment was discovered about a mile southwest on the Amos Pingrey farm. This piece weighed 152 pounds and had dug a hole four feet deep. Over the next few months, particularly after fires had burned off the prairie, hundreds of small fragments, ranging in size from bullets to hen's eggs were picked up in the area between Superior and Estherville.

The final large piece of the Estherville meteorite, however, was not discovered until more than nine months after the fall. Two brothers had noticed a fragment impact in a slough about four miles southwest of the main fall site. Though noting this, they seem to have taken no action until the following February, when they were trapping in the slough. At that time, they discovered a five foot hole containing a 101 pound meteorite and several smaller pieces.

The final distribution of the nearly one thousand pounds of meteoric material covers most of the important museums of the world. It also became souvenirs and articles of jewelry for a number of Estherville residents. Most of the large fragments were purchased, or otherwise acquired by Keokuk lawyer Charles Birge, who ultimately sold them for a handsome profit to a variety of American and European museums.

The Estherville meteorite was described by Harvey Nininger, the renown meteorite specialist, as "one of the great falls of history." First, it was a large stoney-iron meteorite, the rarest of the major meteorite types. And secondly, as he puts it, "Apart from this unique shower, very few meteorites had ever been recovered promptly enough after arrival for a detailed study of surface features as they existed at the end of the flight." More than 600 little pellets derived from the meteor are catalogued at Yale University alone.

The Forest City Meteorite

Eleven years after the Estherville meteorite, the next Iowa fall occurred about 60 miles further east, near Forest City. The meteor was first noticed at approximately 5:15 in the afternoon on May 2, 1890. The sky was nearly cloudless, as the meteor came in from the southwest at the head of a trail of black smoke. It was noted to be "sputtering and throwing off a long train of sparks" as it passed to the northeast. Some observers compared the fireball's brightness to that of the sun. The sight was noted as far away as Chamberlain, South Dakota, 300 miles west. In fact, the Forest City meteor has been described as "one of the best observed meteors ever."

In a manner similar to the Estherville meteor, this meteor also appears to have detonated and broken apart at a considerable height above the countryside, scattering about 1000 pounds of debris over an area three to four miles in length and one and a half to two miles in width. Residents mentioned hearing a noise which they likened to "heavy connoading, accompanied by a rushing or hissing sound." The actual fall site was adjacent to and partially covering the small town of Thompson. The meteorite, however, was called the Forest City meteorite, after the county seat located 11 miles to the southeast.

The largest piece recovered weighs 81 pounds and is currently on display in the American Museum of Natural History. The only other large piece remaining is a 66-pound fragment owned by the University of Minnesota. More than a thousand other small pieces ranging in size from a few ounces to a few pounds are in museums around the world. Unfortunately, a number of these did not start out as small pieces. As in the case of the Marion meteorite 43 years before, a local farmer broke up several recovered fragments in search of silver.

The meteorite contained no silver, however. It was the most common of meteorites again, an ordinary chondrite, or stoney meteorite. What the farmer extracted were small specks and filaments of bright nickel-iron.

The Mapleton Meteorite

The most recent large meteorite recovered in Iowa was discovered in 1939. It is in a class by itself because it is the only iron meteorite discovered within the state. Furthermore, its exact date of fall is unknown.

On the morning of June 17, 1939, Harvey Meevers was cultivating corn on his farm about three miles east and a mile north of Mapleton, when his cultivator caught on a heavy object. After digging the object out, he noticed that it appeared denser and of a different texture than any stone he had unearthed before. As a result, he brought it back to the barn as a curiosity.

Fortunately, the following month, *National Geographic Magazine* carried an article on meteorites, and Meever's attention was drawn to the article. He quickly became convinced that his 108 pound mass of iron was indeed a meteorite. He wrote to the Field Museum in Chicago, offering a small chip from the meteorite for verification. The museum quickly responded and purchased the meteorite. It is currently on display in their "Meteorite Hall," together with a considerable amount of meteoric debris from the other Iowa falls.

Attempts to determine the date of the fall have not been entirely successful. The meteorite showed very little weathering which suggests that it fell recently. But "recently" could mean a few years ago or perhaps a few hundred years ago.

Local speculation has identified two possible dates for the fall. One was on or about Thanksgiving 1916. At about 10:00 that night, a great fireball was observed by a number of people near Mapleton, as it passed overhead in a northeasterly direction. Shortly afterward, a loud explosion rocked the area. The Mapleton meteorite could be a fragment from that event.

Six months later, another spectacular meteor was sighted in the area. This, too, has been suggested as having produced the Mapleton meteorite. Astronomer David Hadden of Alta, Iowa, described it in a note in *Popular Astronomy* (1917). At about 9:55 on the evening of May 31, 1917, a bright meteor streaked across the western sky, moving in a southerly direction. Toward the end of its flight, it appeared to detonate into fragments.

Possibly neither of the above events created the Mapleton meteorite. But if either did, the meteorite lay undiscovered for 22 years, and other pieces of the meteorite may be in the area, as yet unfound.

Undoubtedly, many meteorites still lie undiscovered in the fields and forests of Iowa because they have been overlooked. They are easily missed since the vast majority of meteorites appear outwardly identical to terrestrial rocks. Unless they are seen to fall, only the irons, since they are odd in appearance, are brought in.

We can be just as sure that falls will continue to occur in the future. But an examination of our own state's history, where four falls occurred within half a century and no verified falls have been documented in nearly a century since, gives us an indication of the sporadic nature and unpredictability of meteorites.

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